General

Guideline Title

Use of imaging in cerebrovascular disease.

Bibliographic Source(s)

Irimia P, Asenbaum S, Brainin M, Chabriat H, Martinez-Vila E, Niederkorn K, Schellinger PD, Seitz RJ, Masdeu JC. Use of imaging in cerebrovascular disease. In: Gilhus N, Barnes MP, Brainin M, editor(s). European handbook of neurological management. 2nd ed. Vol. 1. Oxford (UK): Wiley-Blackwell; 2011. p. 19-34. [207 references]

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Masdeu JC, Irimia P, Asenbaum S, Bogousslavsky J, Brainin M, Chabriat H, Herholz K, Markus HS, Martinez-Vila E, Niederkorn K, Schellinger PD, Seitz RJ, EFNS. EFNS guideline on neuroimaging in acute stroke. Report of an EFNS task force. Eur J Neurol 2006 Dec;13(12):1271-83.

Recommendations

Major Recommendations

The levels of evidence (Class I-IV) supporting the recommendations and ratings of recommendations (A-C, Good Clinical Practice Point [GCPP]) are defined at the end of the "Major Recommendations" field.

Imaging of the Brain

- Either non-contrast computed tomography (CT) or magnetic resonance imaging (MRI) should be used for the definition of stroke type and treatment of stroke (Class I, Level A).
- The presence of early CT infarct signs cannot be construed as an absolute contraindication to thrombolysis in the first 3 h after stroke (Class IV, GCPP).
- MRI has a higher sensitivity than conventional CT for the documentation of infarction within the first hours of stroke onset, lesions in the posterior fossa, identification of small lesions, and documentation of vessel occlusion and brain oedema (Class I, Level A).
- In conjunction with MRI and magnetic resonance angiography (MRA), perfusion and diffusion MR are very helpful for the evaluation of patients with acute ischaemic stroke (Class I, Level A).
- Single photon emission computed tomography (SPECT) is helpful to predict the malignant course of brain swelling with large hemispheric infarctions (Class III, Level C). SPECT is also helpful in the evaluation of cerebral perfusion in non-acute cerebrovascular disease, for instance in the days after a subarachnoid haemorrhage (SAH) (Class III, Level C).

Detection of Hemorrhagic Stroke

- MRI can detect acute and chronic intracerebral haemorrhage (Class I, Level A).
- Although the detection of SAH is possible with MRI, currently CT scan is the diagnostic procedure of choice (Class I, Level A). In case of doubt or negative CT scan, lumbar puncture and cerebrospinal fluid (CSF) analysis is recommended (Class I, Level B)

Imaging of Extracranial Vessels

- Although MRA has slightly higher sensitivity and specificity than ultrasonography (US) to determine carotid stenosis and occlusion, the usefulness of either procedure may be determined by other factors, such as availability (Class II, Level B).
- CT angiography (CTA) has a sensitivity and specificity similar to MR for carotid occlusion and similar to US for the detection of severe stenosis (Class II, Level B).
- Digital subtraction angiography (DSA) is generally recommended for grading carotid stenosis prior to endarterectomy (Class I, Level A), but when there is concordance of non-invasive methods cerebral arteriography may not be necessary (Class IV, GCPP).

Imaging of Intracranial Vessels

- Transcranial Doppler (TCD) is very useful for assessing stroke risk of children aged 2 to 16 years with sickle cell disease (Class II, Level B), detection and monitoring of vasospasm after SAH (Class I, Level A), diagnosis of intracranial steno-occlusive disease (Class II, Level B), diagnosis of right-to-left shunts (Class II, Level A), and for monitoring arterial recanalization after thrombolysis of acute middle cerebral artery (MCA) occlusions (Class II, Level B).
- TCD can detect cerebral emboli and impaired cerebral haemodynamics. The presence of embolic signals with carotid stenosis predicts early recurrent stroke risk (Class II, Level A). The detection of impaired cerebral haemodynamics in carotid occlusion may identify a group at high risk of recurrent stroke (Class III, Level B).
- MRA and CTA are very useful for the diagnosis of intracranial stenosis and cerebral aneurysms >5 mm (Class II, Level B). MRA and CTA are the recommended techniques for screening cerebral aneurysms in individuals with a history of aneurysms or SAH in a first-degree relative (Class II, Level B).
- DSA is the recommended technique for the diagnosis of cerebral aneurysm as the cause of SAH (Class I, Level A). CTA can be used as a reliable alternative to DSA in patients with SAH, particularly in cases in which the risk of delaying surgery for a catheter study is not justified (Class II, Level B).
- MRI with MRA is recommended for the diagnosis and follow-up of cerebral venous thrombosis (Class II, Level B). Alternatively, CT venography is accurate and can be used for the same purpose (Class III, Level C).

Definitions:

Evidence Classification Scheme for a Diagnostic Measure

Class I: A prospective study in a broad spectrum of persons with the suspected condition, using a 'gold standard' for case definition, where the test is applied in a blinded evaluation, and enabling the assessment of appropriate tests of diagnostic accuracy

Class II: A prospective study of a narrow spectrum of persons with the suspected condition, or a well-designed retrospective study of a broad spectrum of persons with an established condition (by 'gold standard') compared to a broad spectrum of controls, where test is applied in a blinded evaluation, and enabling the assessment of appropriate tests of diagnostic accuracy

Class III: Evidence provided by a retrospective study where either persons with the established condition or controls are of a narrow spectrum, and where test is applied in a blinded evaluation

Class IV: Any design where test is not applied in blinded evaluation OR evidence provided by expert opinion alone or in descriptive case series (without controls)

Rating of Recommendations

Level A rating (established as useful/predictive or not useful/predictive) requires at least one convincing class I study or at least two consistent, convincing class II studies.

Level B rating (established as probably useful/predictive or not useful/predictive) requires at least one convincing class II study or overwhelming class III evidence.

Level C rating (established as possibly useful/predictive or not useful/predictive) requires at least two convincing class III studies.

Good Clinical Practice Point Where there was lack of evidence but consensus was clear the task force members have stated their opinion as Good Clinical Practice Points.

Clinical Algorithm(s)

None provided

Scope

Disease/Condition(s)

Acute stroke (cerebrovascular disease)

Guideline Category

Diagnosis

Evaluation

Technology Assessment

Clinical Specialty

Emergency Medicine

Family Practice

Internal Medicine

Neurology

Nuclear Medicine

Radiology

Intended Users

Health Care Providers

Physicians

Guideline Objective(s)

- To actualize the European Federation of Neurological Societies (EFNS) Guideline on the use of neuroimaging for the management of acute stroke published in 2006
- To provide updated and evidence-based recommendations regarding the use of diagnostic neuroimaging techniques, including cerebrovascular ultrasonography (US), in patients with stroke and thus guide neurologists, other healthcare professionals and healthcare providers in clinical decision making and in the elaboration of clinical protocols

Target Population

Patients with acute stroke

Interventions and Practices Considered

1. Computed tomography (CT), perfusion CT (PCT)
2. Magnetic resonance imaging (MRI), diffusion-weighted (DWI) and perfusion-weighted (PWI) MRI
3. Magnetic resonance angiography (MRA)
4. Single photon emission computed tomography (SPECT)
5. Positron emission tomography (PET) (considered but not recommended)
6. Ultrasonography (US)
7. CT angiography (CTA)
8. Digital subtraction angiography (DSA)
9. Transcranial Doppler (TCD)
10. CT venography

Major Outcomes Considered

Sensitivity, specificity, and usefulness of diagnostic tests

Methodology

Methods Used to Collect/Select the Evidence

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

The Cochrane Library was consulted and no studies were found regarding the use of neuroimaging techniques in stroke. A comprehensive literature review using the Medline database has been conducted by searching for the period 1965–2009. Relevant literature in English including existing guidelines, meta-analyses, systematic reviews, randomized controlled trials, and observational studies has been critically assessed.

Number of Source Documents

Not stated

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

Evidence Classification Scheme for a Diagnostic Measure

Class I: A prospective study in a broad spectrum of persons with the suspected condition, using a 'gold standard' for case definition, where the test is applied in a blinded evaluation, and enabling the assessment of appropriate tests of diagnostic accuracy

Class II: A prospective study of a narrow spectrum of persons with the suspected condition, or a well-designed retrospective study of a broad spectrum of persons with an established condition (by 'gold standard') compared to a broad spectrum of controls, where test is applied in a blinded evaluation, and enabling the assessment of appropriate tests of diagnostic accuracy

Class III: Evidence provided by a retrospective study where either persons with the established condition or controls are of a narrow spectrum, and where test is applied in a blinded evaluation

Class IV: Any design where test is not applied in blinded evaluation OR evidence provided by expert opinion alone or in descriptive case series (without controls)

Methods Used to Analyze the Evidence

Review of Published Meta-Analyses

Systematic Review

Description of the Methods Used to Analyze the Evidence

Selected articles have been rated based on the quality of study design, according to European Federation of Neurological Societies (EFNS) criteria (see the "Rating Scheme for the Strength of the Evidence" field).

Methods Used to Formulate the Recommendations

Expert Consensus

Description of Methods Used to Formulate the Recommendations

The author panel critically assessed the topic through analysis of the medical literature. Clinical practice recommendations have been developed and stratified to reflect the quality and the content of the evidence according to European Federation of Neurological Societies criteria (see the "Availability of Companion Documents" field). A draft guideline with specific recommendations was circulated to all panel members. Each panellist studied and commented in writing on this draft, which was revised to progressively accommodate the panel consensus. After the approval of the panellists, two independent experts gave their opinion on the final version.

Rating Scheme for the Strength of the Recommendations

Rating of Recommendations

Level A rating (established as useful/predictive or not useful/predictive) requires at least one convincing class I study or at least two consistent, convincing class II studies.

Level B rating (established as probably useful/predictive or not useful/predictive) requires at least one convincing class II study or overwhelming class III evidence.

Level C rating (established as possibly useful/predictive or not useful/predictive) requires at least two convincing class III studies.

Good Clinical Practice Point Where there was lack of evidence but consensus was clear the task force members have stated their opinion as Good Clinical Practice Points.

Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

Method of Guideline Validation

Peer Review

Description of Method of Guideline Validation

The guidelines were validated according to the European Federation of Neurological Societies (EFNS) criteria (see the "Availability of Companion Documents" field).

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The type of supporting evidence is identified and graded for each recommendation (see the "Major Recommendations" field).

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

Appropriate use of neuroimaging for the diagnosis of acute stroke

Potential Harms

Angiography carries the risk of stroke and death, and many centres are not using digital subtraction angiography (DSA) prior to carotid endarterectomy, particularly when non-invasive methods are concordant.

Contraindications

Contraindications

- Pregnancy, diabetes, renal failure, and allergy to contrast material are relative contraindications to performing a perfusion brain computed tomography (CT).
- Limitations and contraindications for the use of magnetic resonance imaging (MRI) are: claustrophobia, agitation, morbid obesity, the presence of intracranial ferromagnetic elements, an aneurysm recently clipped or coiled, otic or cochlear implants, some old prosthetic heart valves, pacemakers, and some, not all, neurostimulators.

Qualifying Statements

Qualifying Statements

- This guideline provides the view of an expert task force appointed by the Scientific Committee of the European Federation of Neurological Societies (EFNS). It represents a peer-reviewed statement of minimum desirable standards for the guidance of practice based on the best available evidence. It is not intended to have legally binding implications in individual cases.
- The original guideline is intended to provide updated and evidence-based recommendations regarding the use of diagnostic neuroimaging techniques, including cerebrovascular ultrasonography (US), in patients with stroke and thus guide neurologists, other healthcare professionals and healthcare providers in clinical decision making and in the elaboration of clinical protocols. It is not intended to have legally binding implications in individual situations.

Implementation of the Guideline

Description of Implementation Strategy

The European Federation of Neurological Societies has a mailing list and all guideline papers go to national societies, national ministries of health, World Health Organisation, European Union, and a number of other destinations. Corporate support is recruited to buy large numbers of reprints of the guideline papers and permission is given to sponsoring companies to distribute the guideline papers from their commercial channels, provided there is no advertising attached.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Getting Better

IOM Domain

Effectiveness

Timeliness

Identifying Information and Availability

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Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

2006 Dec (revised 2011)

Guideline Developer(s)

European Academy of Neurology - Medical Specialty Society

Source(s) of Funding

European Federation of Neurological Societies

Guideline Committee

European Federation of Neurological Societies Task Force on Use of Imaging in Cerebrovascular Disease

Composition of Group That Authored the Guideline

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Financial Disclosures/Conflicts of Interest

J. Masdeu received an honorarium as Editor-in-Chief of the *Journal of Neuroimaging*. With regard to this manuscript there is no conflict of interest.

P. D. Schellinger has received travel stipends, advisory board and speaker's honoraria from Boehringer Ingelheim, the manufacturers of Alteplase.

The rest of authors have reported no conflicts of interest relevant to this manuscript.

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Guideline Availability

Electronic copies: Available in Portable Document Format (PDF) from the European Federation of Neurological Societies (EFNS) Web site .

Availability of Companion Documents

The following is available:

- Brainin M, Barnes M, Baron JC, Gilhus NE, Hughes R, Selmaj K, Waldemar G; Guideline Standards Subcommittee of the EFNS Scientific Committee. Guidance for the preparation of neurological management guidelines by EFNS scientific task forces – revised recommendations 2004. Eur J Neurol. 2004 Sep;11(9):577-81. Electronic copies: Available in Portable Document Format (PDF) from the European Federation of Neurological Societies Web site .

Patient Resources

None available

NGC Status

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